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(71)Applicant : SHARP CORP

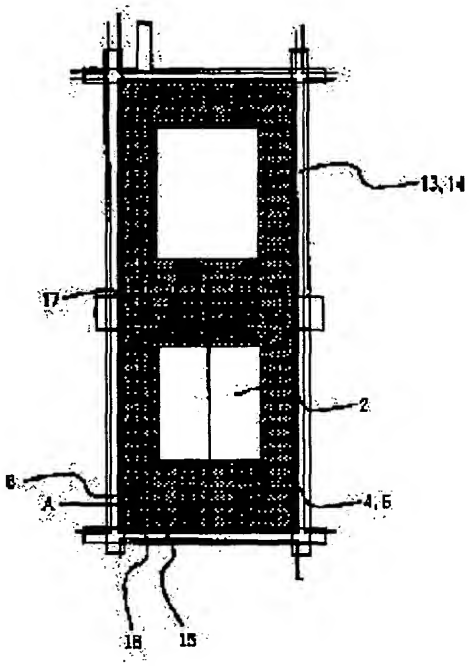
(72)Inventor : KUBO MASUMI
YAMAMOTO AKIHIRO

(54) LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent contact failure between a reflection electrode and a thin film transistor, to improve the use efficiency of ambient light and to obtain good display characteristics by forming the reflection electrode on an interlayer insulating film and electrically connecting the reflection electrode and a transmission electrode in the border region of these electrodes.

SOLUTION: A thin film transistor 18, a transmission electrode 2 electrically connected to the drain electrode 13 of the thin film transistor 18, and reflection electrodes 4, 5 disposed on the thin film transistor 18 and the transmission electrode 2 through an interlayer insulating film are formed on an insulating substrate. The transmission electrode 2 and the reflection electrodes 4, 5 are electrically connected in the border region of these electrodes. By electrically connecting the reflection electrodes 4, 5 and the transparent electrode 2 in the border region, contact failure can be decreased, and the use efficiency of ambient light and the numerical aperture in the reflection electrode region can be improved to obtain good display performance.



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CLAIMS

[Claim(s)]
[Claim 1] The pixel electrode which constitutes the reflector which reflects outdoor daylight on the substrate of the one side of the substrates of the couple which counters mutually and is arranged on both sides of a liquid crystal layer, and the transparency electrode which penetrates the light from the source of a back light in 1 pixel, In the liquid crystal display with which it comes to form the switching element section which impresses the voltage for a display to this pixel electrode, while a layer insulation film is formed on the substrate of the aforementioned one side It comes electrically to connect the drain electrode and the aforementioned transparency electrode which constitute the aforementioned switching element section under this layer insulation film. the aforementioned reflector The liquid crystal display characterized by connecting this reflector and a transparency electrode electrically in the border area of this reflector and a transparency electrode while being formed on the aforementioned layer insulation film.
[Claim 2] The aforementioned layer insulation film is a liquid crystal display according to claim 1 characterized by covering all on the switching element section containing the aforementioned drain electrode, being formed, and a contact hole not existing on the aforementioned reflector.
[Claim 3] The aforementioned reflector and the aforementioned transparency electrode are a liquid crystal display according to claim 1 characterized by connecting electrically only in the border area of this reflector and a transparency electrode.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the liquid crystal display used for the camcorder/movie equipped with OA equipment, such as a word processor and a personal computer, pocket information machines and equipment, such as an electronic notebook, or the liquid crystal display monitor etc.
[0002]
[Description of the Prior Art] In recent years, the liquid crystal display is widely used for a word processor, a personal computer, television, a video camera, a still camera, a mounted monitor, pocket OA equipment, the handheld game machine, etc. taking advantage of the feature of being a low power, with the thin shape.
[0003] A transparency [which used transparency electrodes, such as ITO (Indium Tin Oxide) for the pixel electrode] type liquid crystal display, and the reflected type liquid crystal display which used reflectors, such as a metal, for the pixel electrode are shown in such a liquid crystal display.
[0004] Originally, liquid crystal displays differ in CRT (Braun tube), EL (electroluminescence), etc., since they are not the spontaneous light type display which emits light itself, in the case of a penetrated type liquid crystal display, arrange lighting systems, such as a fluorescence pipe, and the so-called back light behind a liquid crystal display, and show to it by the light by which incidence is carried out from there. Moreover, in the case of a reflected type liquid crystal display, it is displaying by reflecting the incident light from the outside by the reflector.
[0005] Without being influenced so much by the surrounding luminosity, in order to display here using a back light as mentioned above in the case of a penetrated type liquid crystal display, although it has the advantage that the display which is bright and has high contrast can be performed, since a back light consumes 50% or more of the total power consumption of a liquid crystal display, it also usually has the problem that power consumption will become large.
[0006] Moreover, in the case of the reflected type liquid crystal display, although it has the advantage that power consumption can be made very small in order not to use a back light as mentioned above, it also has the problem that the luminosity and contrast of a display by a surrounding operating environment or surrounding service conditions, such as a luminosity, will be influenced.
[0007] Thus, in the reflected type liquid crystal display, when operating environments, such as a surrounding luminosity, especially outdoor daylight were dark, it had the fault that visibility fell extremely, and also in the one transparency type liquid crystal display, with this, when outdoor daylight was very bright conversely, it had the problem that the visibility under fine weather etc. will fall.
[0008] As a means for solving such a trouble, the liquid crystal display having the function of both a reflected type and a penetrated type is proposed by Japanese Patent Application No. No. 201176 [nine to] etc. The liquid crystal display proposed by this patent application By making the reflective display (reflector) which reflects outdoor daylight in one display pixel, and the transparency display (transparency electrode) which penetrates the light from a back light, when the circumference is pitch-black As a penetrated type liquid crystal display which displays using the light which penetrates the transparency display from a back light, when outdoor daylight is dark As a two-ways type liquid crystal display which displays using both the light which penetrates the transparency display from a back light, and the light reflected by the reflective display formed with the comparatively high film of the rate of a light reflex Furthermore, when outdoor daylight is bright, it can use as a reflected type liquid crystal display which displays only using the light reflected by the reflective display formed with the comparatively high film of the rate of a light reflex.
[0009] The liquid crystal display of such composition is not concerned with the luminosity of outdoor daylight, but enables offer of a liquid crystal display in which visibility was always excellent, and explains it briefly [below] about such a transparency reflective two-ways type liquid crystal display.
[0010] it is the plan having shown the composition of the pixel portion of the transparency reflective two-ways type

liquid crystal display which drawing 10 makes the conventional technology here and is explained, and drawing 11 is an A-A line cross section in drawing 10

[0011] Moreover, drawing 12 (a) - (d) and drawing 13 (e) - (h) is the process cross section having shown the manufacturing process of the transparency display and reflective display in the pixel portion of a these transparency reflective two-ways type liquid crystal display.

[0012] The transparency display and reflective display which constitute the pixel portion of such a transparency reflective two-ways type liquid crystal display are explained with reference to drawing 10 -13. first, it is shown in drawing 12 (a) -- as -- the insulating substrate 1 top -- as a base coat film -- Ta2 -- insulator layers, such as O5 and Si02, are formed (not shown), after that, on the insulating substrate 1, patterning of the metal thin film which consists of aluminum, Mo, Ta, etc. is created and carried out by the sputtering method, and the gate electrode 8 is formed

[0013] Next, the gate electrode 8 mentioned above is covered and the laminating of the gate insulator layer 10 is carried out on the insulating substrate 1. Generally, by P-CVD, 3000A laminating of the SiNx film was carried out, and it considered as the gate insulator layer 10. In addition, in order to raise insulation, anodizing the gate electrode 8, making this oxide film on anode into the 1st gate insulator layer 9, forming the insulator layers 10, such as SiN, by CVD, and considering as the 2nd insulator layer 10 is also considered.

[0014] Next, by CVD, the channel layer 11 (amorphous silicon) and the electrode contact layer 12 (the amorphous silicon or microcrystal (Si) which doped impurities, such as Lynn) are continued on the gate insulator layer 10, 500A laminating is carried out to 1500A, respectively, patterning of both the Si film of the electrode contact layer 12 and the channel layer 11 is carried out by the dry etching method by HCl+SF6 mixed gas etc., and it is formed.

[0015] Then, as shown in drawing 12 (b), 1500A laminating of the transparent electric conduction films (ITO) 2 and 13 is carried out as an electrode material which constitutes a transparency display by the sputtering method, then the laminating of the metal thin films 14 and 15, such as aluminum, Mo, and Ta film, is carried out. And the source electrodes 13 and 14 and the drain electrodes 13 and 15 are formed by carrying out patterning of these.

[0016] Next, as shown in drawing 12 (c), after carrying out 3000A laminating of the insulator layers, such as SiN, in CVD, it removes, patterning of the insulator layer which exists on the contact hole section 17 is carried out, and an interlayer film 7 is formed.

[0017] Next, two or more smooth concavo-convex sections 18 (not shown) are formed on a photopolymer 3 by heat-treating, after applying the photopolymer 3 used as a layer insulation film by about 4-micrometer thickness on this interlayer film 7 and exposing and developing this photopolymer 3, as shown in drawing 12 (d). And the photopolymer 3 which exists on contact hole section 17 field and a transparency display field is removed.

[0018] Next, as shown in drawing 13 (e), the aluminum/Mo films 4 and 5 are formed 1000/500A thickness by the sputtering method as an electrode material which constitutes a reflective display on the substrate 1 containing an interlayer film 7 and a photopolymer 3.

[0019] And as shown in drawing 13 (f), on the electrode material 4 which constitutes a reflective display, and 5, a photo lithography process is used and a photoresist 16 is formed at a predetermined configuration. Since Mo5 exists between ITO2 which is the electrode material which constitutes a transparency display, and aluminum4 which is the electrode material which constitutes a reflective display at this time, although an electrolytic solution sinks in from the film defective part of aluminum4 at the time of the development of a photoresist 16, since this Mo5 functions as a barrier metal, it has prevented that an electric corrosion reaction occurs.

[0020] And as shown in drawing 13 (g), the etchant which consists of nitric-acid + acetic-acid + phosphoric-acid + water is used, aluminum4/Mo5 which are the electrode material which constitutes a reflective display are **********ed simultaneously, and reflectors 4 and 5 are formed.

[0021] Finally, as shown in drawing 13 (h), the pixel portion of the transparency reflective two-ways type liquid crystal display mentioned above by removing the photoresist 16 formed of photo lithography using the ablation equipment of a batch type is completed.

[0022] Here, the ablation equipment of a batch type used in order to remove the photoresist 16 formed of the aforementioned photo lithography is explained using drawing 14 . Drawing 14 (a) - (c) is the schematic diagram having shown the ablation process of the photoresist 16 of the batch type in the transparency reflective two-ways type liquid crystal display mentioned above.

[0023] the substrate 20 which passed through a process which was mentioned above as shown in drawing 14 (a) - (c) -- as an amine -- MEA (monoethanolamine) -- 60wt(s)% -- it soaks in the ablation liquid 21 to contain, and in order to remove the ablation liquid 21 of substrate 20 front face after that, it soaks in water 22 and rinses At this time, in process in which the substrate 20 as shown in drawing 14 (b) is conveyed from an ablation tub to a rinse tank, it is in the state where ablation liquid 21 adhered to substrate 20 front face, and by soaking this substrate 20 in a rinse tank, MEA21 and water 22 are mixed on substrate 20 front face, and alkalinity becomes strong.

[0024] however, in the transparency reflective two-ways type liquid crystal display mentioned above In the border area of a transparency display and a reflective display, as shown in the cross section of drawing 11 Since patterning of an interlayer film 7 and the reflectors 4 and 5 is carried out so that ITO2 which is the electrode material which constitutes a transparency display, and aluminum4/Mo5 which are the electrode material which constitutes a reflective display may not contact directly A photoresist 16 is removable, without causing electric corrosion between ITO2 which is a transparency electrode material, and aluminum4 which is reflector material.
[0025] Thus, an orientation film is applied and calcinated to each of the TFT substrate which has the manufactured pixel portion, and the transparent opposite substrate (not shown) in which the transparency electrode was formed. And rubbing processing is performed to this orientation film, after sprinkling a spacer, liquid crystal is poured in for both these substrates by lamination and the vacuum pouring-in method by the seal resin, and a liquid crystal display element is created. The transparency reflective two-ways type liquid crystal display mentioned above by pouring in liquid crystal material, installing a polarizing plate and one phase contrast board at a time in the both sides of a liquid crystal display element finally, respectively, and installing a back light in a tooth back is completed.
[0026]
[Problem(s) to be Solved by the Invention] Since the interlayer film 7 is formed so that the electrode material 2 which constitutes a transparency display, and the electrode materials 4 and 5 which constitute a reflective display may not contact directly, the transparency reflective two-ways type liquid crystal display of composition as mentioned above is effective composition to preventing the electric corrosion which happens between the transparency electrode material 2 and the reflector material 4 and 5.
[0027] However, in such composition, since the lap portion of the electrode material 2 which constitutes a transparency display, the electrode materials 4 and 5 which constitute a reflective display, and an interlayer film 7 also became a transparency display with the invalid viewing area which cannot be used for a reflective display, either, being in a display pixel field, it had the trouble that a numerical aperture will fall as display.
[0028] Moreover, the interlayer film 7 in the reflective field at this time, and the border area of a transparency field Reflectors 4 and 5 need to carry out patterning gap consideration, and it is necessary to form quite more greatly than the edge portion of reflectors 4 and 5. The sake, The field which must impress voltage to liquid crystal through an interlayer film 7 in a part of transparency field will exist, and it also had the problem that the permeability and contrast of a display in a transparency field will fall.
[0029] Furthermore, when performing a reflective display in such a transparency reflective two-ways type liquid crystal display, reservation of the area of the reflectors 4 and 5 for performing sufficient reflective display became difficult from having to divide one pixel in a transparency field and a reflective field, and also the contact hole 17 existing in this reflective field, and it also had the trouble that the use efficiency of an ambient light was bad.
[0030] Generally, in a transparency reflective two-ways type liquid crystal display which was mentioned above, since it is necessary to connect the transparency electrode 2 and reflectors 4 and 5 electrically through the layer insulation film (photopolymer) 3, it is necessary to form a contact hole 17 in the layer insulation film 3. When using polarization mode especially, it is necessary to aim at matching of the electro-optics property between these both by adjusting the optical path length of a reflective field and a transparency field using the thickness of the layer insulation film 3. Usually, it is necessary to set the thickness of the liquid crystal layer of a transparency field as the double-precision grade of the thickness of the liquid crystal layer of a reflective field. Since the liquid crystal thickness of a transparency field is usually about 5-6 micrometers, it is necessary to form the layer insulation film 3 in the thick thickness of [that the liquid crystal thickness of a reflective field is set to about 2.5-3 micrometers] about 3 micrometers. For example, this sake, It also has the problem that will be easy to generate the faulty connection in a contact hole 17, and the area of a contact hole 17 will also become large, and the use efficiency of reflectors 4 and 5 will become bad.
[0031] It is made hard to happen in poor contact of the reflector of a transparency reflective two-ways type liquid crystal display, and TFT, and the place which this invention is made in view of the trouble of these former, and is made into the purpose raises the use efficiency of an ambient light, and is to offer the transparency reflective two-ways type liquid crystal display which has a good display property.
[0032]
[Means for Solving the Problem] In order to attain the purpose mentioned above, the liquid crystal display of this invention The pixel electrode which constitutes the reflector which reflects outdoor daylight on the substrate of the one side of the substrates of the couple which counters mutually and is arranged on both sides of a liquid crystal layer, and the transparency electrode which penetrates the light from the source of a back light in 1 pixel, In the liquid crystal display with which it comes to form the switching element section which impresses the voltage for a display to this pixel electrode, while a layer insulation film is formed on the substrate of the aforementioned one side It comes electrically to connect the drain electrode and the aforementioned transparency electrode which constitute the

aforementioned switching element section under this layer insulation film. the aforementioned reflector While being formed on the aforementioned layer insulation film, this reflector and the transparency electrode are characterized by connecting electrically in the border area of this reflector and a transparency electrode.
[0033] Moreover, it is desirable that the aforementioned layer insulation film at this time covers all on the switching element section containing the aforementioned drain electrode, and is formed, and a contact hole does not exist on the aforementioned reflector.
[0034] Furthermore, as for the aforementioned reflector and the aforementioned transparency electrode at this time, it is desirable to connect electrically only in the border area of this reflector and a transparency electrode.
[0035] Hereafter, an operation of this invention is explained.
[0036] Without making the invalid viewing area in a display pixel field increase conventionally, since according to the liquid crystal display of this invention the reflector and the transparency electrode are constituted so that it may connect electrically in the border area of a reflector and a transparency electrode, two electrodes can be connected certainly and it is possible to reduce poor contact.
[0037] Moreover, since a reflector and a transparency electrode can be connected electrically, without forming the contact hole which existed in the reflector field in a display pixel field until now, it is also possible to raise the numerical aperture of a reflector field and to raise the use efficiency of an ambient light.
[0038] Furthermore, since it becomes unnecessary to form the interlayer film which existed between the reflector and the transparency electrode until now, it is also possible for impressing voltage to liquid crystal through an interlayer film to be lost, and to raise the display performance of a transparency electrode field.
[0039]
[Embodiments of the Invention] Hereafter, the gestalt of the operation in this invention is explained based on a drawing.
[0040] (Form 1 of operation) Drawing 1 is the plan having shown the composition of the pixel portion of the liquid crystal display in the form 1 of this operation, and drawing 2 is the A-A line cross section.
[0041] The liquid crystal display of the form 1 of this operation is formed on the insulating substrate 1 from TFT 18, the transparency electrode 2 electrically connected to the drain electrode 13 of this TFT 18, this TFT 18 and the transparency electrode 2, and the reflectors 4 and 5 arranged through the layer insulation film 3, as shown in drawing 1 and drawing 2 . And in the border area, it connects electrically and these transparency electrode 2 and reflectors 4 and 5 are constituted.
[0042] Thus, since the transparency electrode 2 and reflectors 4 and 5 which constitute a pixel electrode from a liquid crystal display in the form 1 of this operation are contacted directly and connected electrically, it is possible to use also for a transparency viewing area conventionally the invalid viewing area which was not able to be used for the reflective viewing area, either as a connection of the transparency electrode 2 and reflectors 4 and 5.
[0043] Moreover, by considering as such composition, it is possible to prevent conventionally the faulty connection of the transparency electrode 2 and reflectors 4 and 5 which had been generated in the contact hole, and it is also possible to raise the rate of an excellent article of a liquid crystal display.
[0044] As a cure against electric corrosion in the photoresist exfoliation process of the cascade-screen pattern of aluminum4/Mo5 which originates in contacting directly the transparency electrode 2 and reflectors 4 and 5 which constitute a pixel electrode, and connecting them electrically here, and is generated With the form 1 of this operation, a backwashing-by-water process which two or more another tubs are prepared before a rinse tank, and the water and MEA in a rinse tank are mixed, and prevents a bird clapper alkaline is performed so that it may mention later.
[0045] Here, drawing 3 (a) - (d) and drawing 4 (e) - (h) is the cross section having shown the process of the transparency display and reflective display in a pixel portion of a liquid crystal display in the form 1 of this operation.
[0046] The transparency display and reflective display which constitute the pixel portion of the liquid crystal display in the form 1 of this operation are explained with reference to (a) - (h) of drawing 3 and drawing 4 . first, it is shown in drawing 3 (a) -- as -- the insulating substrate 1 top -- as a base coat film -- Ta2 -- insulator layers, such as O5 and Si02, are formed (not shown), after that, patterning of the metal thin film which becomes the insulating substrate 1 from aluminum, Mo, Ta, etc. is created and carried out by the sputtering method, and the gate electrode 8 is formed
[0047] Next, the gate electrode 8 mentioned above is covered and the laminating of the gate insulator layer 10 is carried out on the insulating substrate 1. Generally, by P-CVD, 3000A laminating of the SiNx film was carried out, and it considered as the gate insulator layer 10. In addition, in order to raise insulation, anodizing the gate electrode 8, making this oxide film on anode into the 1st gate insulator layer 9, forming the insulator layers 10, such as SiN, by CVD, and considering as the 2nd insulator layer 10 is also considered.
[0048] Next, by CVD, the channel layer 11 (amorphous silicon) and the electrode contact layer 12 (the amorphous silicon or microcrystal (Si) which doped impurities, such as Lynn) are continued on the gate insulator layer 10, 500A

pectively, patterning of both the Si film of the electrode contact layer 12 and the
ry etching method by HCl+SF6 mixed gas etc., and it is formed.
), 1500A laminating of the transparent electric conduction films (ITO) 2 and 13
which constitutes a transparency display by the sputtering method, then the
nd 15, such as aluminum, Mo, and Ta film, is carried out. And the source
trodes 13 and 15 are formed by carrying out patterning of these. Thereby, it
trode 13 and the electrode material 2 which constitutes a transparency display

), 3000A laminating of the insulator layers, such as SiN, is carried out in CVD, it
yer which exists in the transparency viewing-area and contact hole section 17 top
viewing area and a reflective viewing area is carried out, and an interlayer film 7
terlayer film 7 with the form 1 of this operation, only a transparency viewing
r film 7 which exists throughout the border area of a transparency viewing area
a reflective viewing area was removed. In addition, it does not matter as
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rt.
cavo-convex sections 18 (not shown) are formed on a photopolymer 3 by heat-
ner 3 used as a layer insulation film by about 4-micrometer thickness on this
veloping this photopolymer 3, as shown in drawing 3 (d). And the photopolymer
17 field and a transparency display field is removed.
e), the aluminum/Mo films 4 and 5 are formed 1000/500A thickness by the
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3.
, on the electrode material 4 which constitutes a reflective display, and 5, a photo
toresist 16 is formed at a predetermined configuration. Since Mo5 exists between
which constitutes a transparency display, and aluminum4 which is the electrode
display at this time, although an electrolytic solution sinks in from the film
ne of the development of a photoresist 16, since this Mo5 functions as a barrier
corrosion reaction occurs.
), the etchant which consists of nitric-acid + acetic-acid + phosphoric-acid +
are the electrode material which constitutes a reflective display are
eflectors 4 and 5 are formed.
4 (h), the pixel portion of the transparency reflective two-ways type liquid crystal
g the photoresist 16 formed of photo lithography using the exfoliation equipment

nt of a batch type used in order to remove the photoresist 16 formed of the
explained using drawing 5 . Drawing 5 (a) - (e) is the schematic diagram having
photoresist 16 of the batch type in the transparency reflective two-ways type
ve.
through a process which was mentioned above as shown in drawing 5 (a) - (e) --
mine) -- 60wt(s)% -- in order to soak in the exfoliation liquid to contain and to
trate 20 front face after that, it soaks in a rinse tank 22 and rinses After exfoliating
shown in drawing 14 at this time, it washes in cold water in order of the exfoliation
nethyl sulfoxide a principal component, and a rinse tank 22. If exfoliation is
xchange of the exfoliation tub 21 and a rinse tank 22 The MEA concentration in
MEA will be continuously carried in in a rinse tank 22, alkalinity will become
cur in the contact portion of the transparency electrode 2 and reflectors 4 and 5 in
wing area and a reflective viewing area.
operation, as shown in drawing 5 (a) - (e), after dipping the substrate 20 in the
********s of another exfoliation tubs 21 were passed, and it rinsed by dipping in
EA is conventionally carried in in a rinse tank 22, alkalinity becomes strong, and it
MEA no longer in a rinse tank 22, and to prevent generating of electric corrosion
generated in the contact portion of the transparency electrode 2 and reflectors 4
rency viewing area and a reflective viewing area makes the exfoliation tub 21

(DMSO tub) two tubs.
[0059] Thus, an orientation film is applied and calcinated to each of the TFT substrate which has the manufactured pixel portion, and the transparent opposite substrate (not shown) in which the transparency electrode was formed. And rubbing processing is performed to this orientation film, after sprinkling a spacer, liquid crystal is poured in for both these substrates by lamination and the vacuum pouring-in method by the seal resin, and a liquid crystal display element is created. The transparency reflective two-ways type liquid crystal display mentioned above by pouring in liquid crystal material, installing a polarizing plate and one phase contrast board at a time in the both sides of a liquid crystal display element finally, respectively, and installing a back light in a tooth back is completed.
[0060] (Form 2 of operation) Drawing 6 is the plan having shown the composition of the pixel portion of the liquid crystal display in the form 2 of this operation, and drawing 7 is the A-A line cross section.
[0061] The liquid crystal display of the form 2 of this operation is formed on the insulating substrate 1 from TFT 18, the transparency electrode 2 electrically connected to the drain electrode 13 of this TFT 18, this TFT 18 and the transparency electrode 2, and the reflectors 4 and 5 arranged through the layer insulation film 3, as shown in drawing 6 and drawing 7 . And in the border area, it connects electrically and these transparency electrode 2 and reflectors 4 and 5 are constituted.
[0062] Thus, since the transparency electrode 2 and reflectors 4 and 5 which constitute a pixel electrode from a liquid crystal display in the form 2 of this operation are contacted directly and connected electrically, it is possible to use also for a transparency viewing area conventionally the invalid viewing area which was not able to be used for the reflective viewing area, either as a connection of the transparency electrode 2 and reflectors 4 and 5.
[0063] Moreover, by considering as such composition, it is possible to prevent conventionally the faulty connection of the transparency electrode 2 and reflectors 4 and 5 which had been generated in the contact hole, and it is also possible to raise the rate of an excellent article of a liquid crystal display.
[0064] In addition, the liquid crystal displays in the gestalt 2 of this operation differ in the gestalt 1 of operation which the point which does not form the contact hole in the reflectors 4 and 5 formed on the layer insulation film 3 mentioned above, as shown in drawing 6 and drawing 7 .
[0065] Here, drawing 8 (a) - (d) and drawing 9 (e) - (h) is the cross section having shown the process of the transparency display and reflective display in a pixel portion of a liquid crystal display in the gestalt 2 of this operation.

[0066] The transparency display and reflective display which constitute the pixel portion of the liquid crystal display in the gestalt 2 of this operation are explained with reference to (a) - (h) of drawing 8 and drawing 9 . first, it is shown in drawing 8 (a) -- as -- the insulating substrate 1 top -- as a base coat film -- Ta2 -- insulator layers, such as O5 and Si02, are formed (not shown), after that, patterning of the metal thin film which becomes the insulating substrate 1 from aluminum, Mo, Ta, etc. is created and carried out by the sputtering method, and the gate electrode 8 is formed
[0067] Next, the gate electrode 8 mentioned above is covered and the laminating of the gate insulator layer 10 is carried out on the insulating substrate 1. Generally, by P-CVD, 3000A laminating of the SiNx film was carried out, and it considered as the gate insulator layer 10. In addition, in order to raise insulation, anodizing the gate electrode 8, making this oxide film on anode into the 1st gate insulator layer 9, forming the insulator layers 10, such as SiN, by CVD, and considering as the 2nd insulator layer 10 is also considered.
[0068] Next, by CVD, the channel layer 11 (amorphous silicon) and the electrode contact layer 12 (the amorphous silicon or microcrystal (Si) which doped impurities, such as Lynn) are continued on the gate insulator layer 10, 500A laminating is carried out to 1500A, respectively, patterning of both the Si film of the electrode contact layer 12 and the channel layer 11 is carried out by the dry etching method by HCl+SF6 mixed gas etc., and it is formed.
[0069] Then, as shown in drawing 8 (b), 1500A laminating of the transparent electric conduction films (ITO) 2 and 13 is carried out as an electrode material which constitutes a transparency display by the sputtering method, then the laminating of the metal thin films 14 and 15, such as aluminum, Mo, and Ta film, is carried out. And the source electrodes 13 and 14 and the drain electrodes 13 and 15 are formed by carrying out patterning of these. Thereby, it connects electrically and the drain electrode 13 and the electrode material 2 which constitutes a transparency display are constituted.
[0070] Next, as shown in drawing 8 (c), 3000A laminating of the insulator layers, such as SiN, is carried out in CVD, it removes, patterning of the insulator layer which exists in the border area of a transparency viewing area and a transparency viewing area, and a reflective viewing area is carried out, and an interlayer film 7 is formed. Here, when removing an interlayer film 7 with the form 2 of this operation, only a transparency viewing area was not removed but the interlayer film 7 which exists throughout the border area of a transparency viewing area and a transparency viewing area, and a reflective viewing area was removed. In addition, it does not matter as composition which the transparency electrode 2 and reflectors 4 and 5 connect electrically by necessarily not removing the interlayer film 7 which exists in

the border area of a transparency viewing area and a reflective viewing area over the whole region, and removing the part.

[0071] Next, two or more smooth concavo-convex sections 18 (not shown) are formed on a photopolymer 3 by heat-treating, after applying the photopolymer 3 used as a layer insulation film by about 4-micrometer thickness on this interlayer film 7 and exposing and developing this photopolymer 3, as shown in drawing 8 (d). And the photopolymer 3 which exists on contact hole section 17 field and a transparency display field is removed.

[0072] Next, as shown in drawing 9 (e), the aluminum/Mo films 4 and 5 are formed 1000/500A thickness by the sputtering method as an electrode material which constitutes a reflective display on the substrate 1 containing an interlayer film 7 and a photopolymer 3.

[0073] And as shown in drawing 9 (f), on the electrode material 4 which constitutes a reflective display, and 5, a photo lithography process is used and a photoresist 16 is formed at a predetermined configuration. Since Mo5 exists between ITO2 which is the electrode material which constitutes a transparency display, and aluminum4 which is the electrode material which constitutes a reflective display at this time, although an electrolytic solution sinks in from the film defective part of aluminum4 at the time of the development of a photoresist 16, since this Mo5 functions as a barrier metal, it has prevented that an electric corrosion reaction occurs.

[0074] And as shown in drawing 9 (g), the etchant which consists of nitric-acid + acetic-acid + phosphoric-acid + water is used, aluminum4/Mo5 which are the electrode material which constitutes a reflective display are **********ed simultaneously, and reflectors 4 and 5 are formed.

[0075] Finally, as shown in drawing 9 (h), the pixel portion of the transparency reflective two-ways type liquid crystal display in the gestalt 2 of this operation is completed by removing like the gestalt 1 of the operation which mentioned above the photoresist 16 formed of photo lithography using the ablation equipment of a batch type.

[0076] Thus, an orientation film is applied and calcinated to each of the TFT substrate which has the manufactured pixel portion, and the transparent opposite substrate (not shown) in which the transparency electrode was formed. And rubbing processing is performed to this orientation film, after sprinkling a spacer, liquid crystal is poured in for both these substrates by lamination and the vacuum pouring-in method by the seal resin, and a liquid crystal display element is created. The transparency reflective two-ways type liquid crystal display mentioned above by pouring in liquid crystal material, installing a polarizing plate and one phase contrast board at a time in the both sides of a liquid crystal display element finally, respectively, and installing a back light in a tooth back is completed.

[0077] Since the contact hole does not exist in the reflectors 4 and 5 formed on the layer insulation film 3 according to the liquid crystal display in the form 2 of this operation, Irregularity can be formed also in the field on the layer insulation film 3 which was being conventionally used as the contact hole. The contact hole portion which was not able to be used for a reflective viewing area can be used also for a transparency viewing area as a reflective viewing area, and it is possible to make effective display pixel area expand.

[0078]

[Effect of the Invention] Without making the invalid viewing area in a display pixel field increase conventionally, since the reflector and the transparency electrode are constituted like the above explanation according to the liquid crystal display of this invention so that it may connect electrically in the border area of a reflector and a transparency electrode, two electrodes can be connected certainly and it is possible to reduce poor contact.

[0079] Moreover, since a reflector and a transparency electrode can be connected electrically, without forming the contact hole which existed in the reflector field in a display pixel field until now, it is also possible to raise the numerical aperture of a reflector field and to raise the use efficiency of an ambient light.

[0080] Furthermore, since it becomes unnecessary to form the interlayer film which existed between the reflector and the transparency electrode until now, it is also possible for impressing voltage to liquid crystal through an interlayer film to be lost, and to raise the display performance of a transparency electrode field.

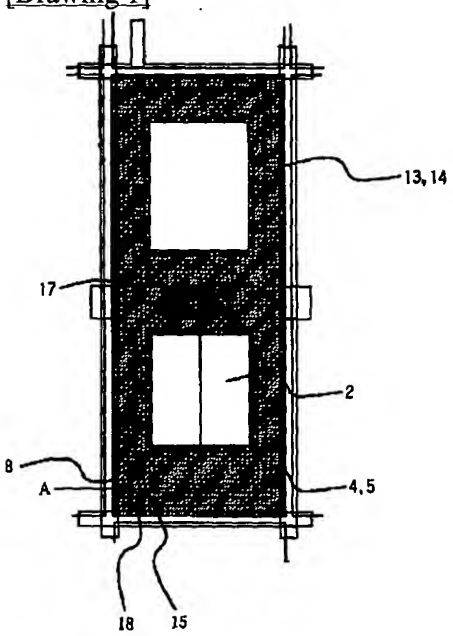
[Translation done.]

* NOTICES *

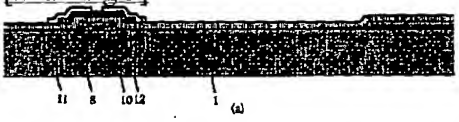
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

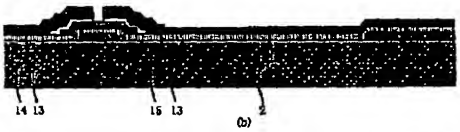
DRAWINGS

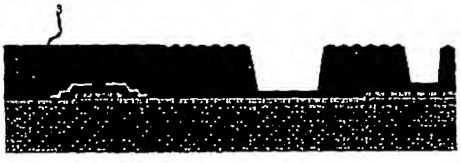
[Drawing 1]



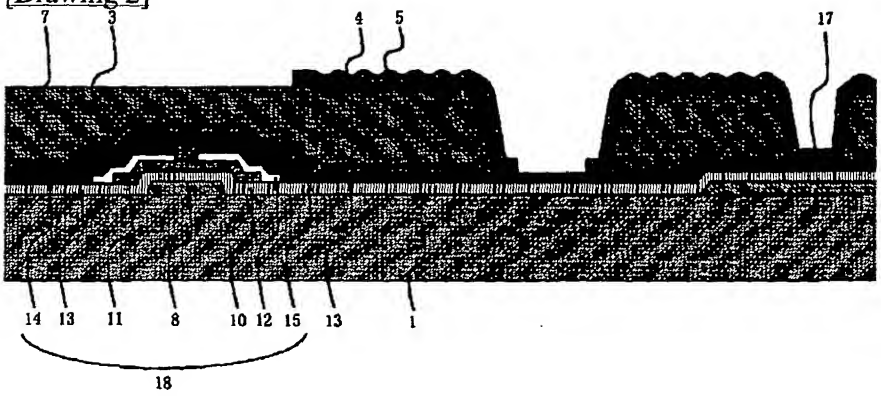
[Drawing 3]



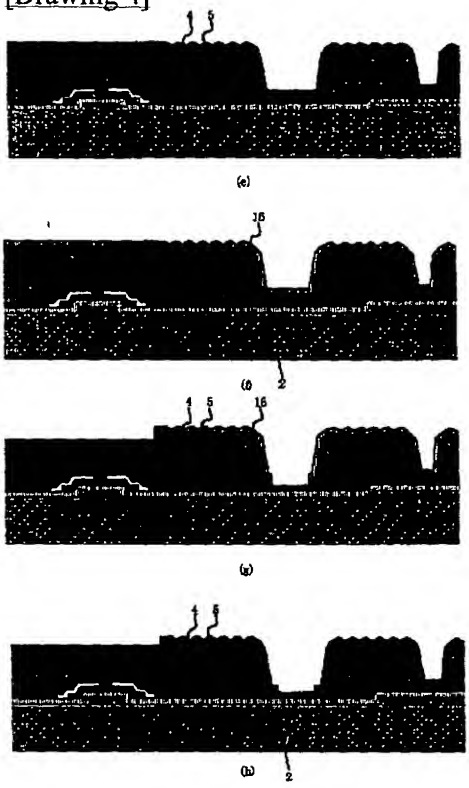




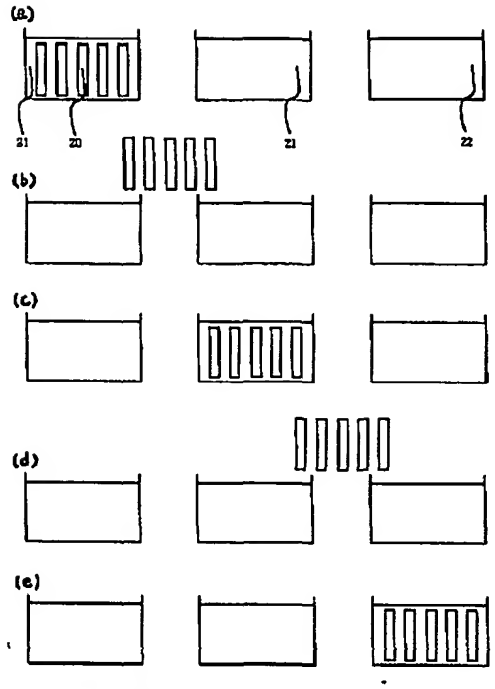
[Drawing 2]



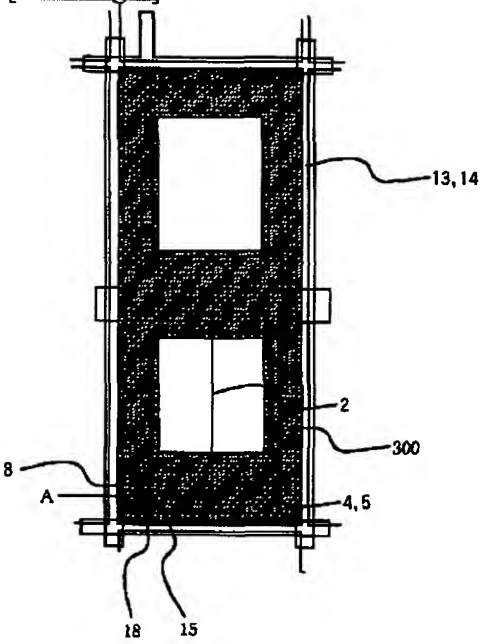
[Drawing 4]



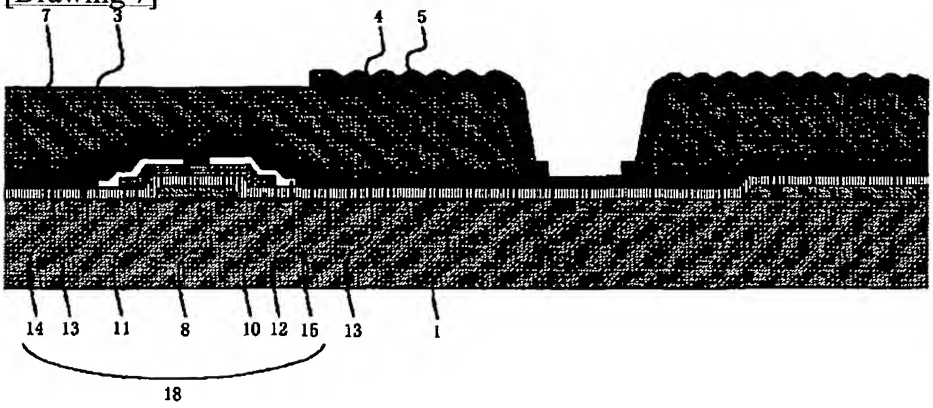
[Drawing 5]



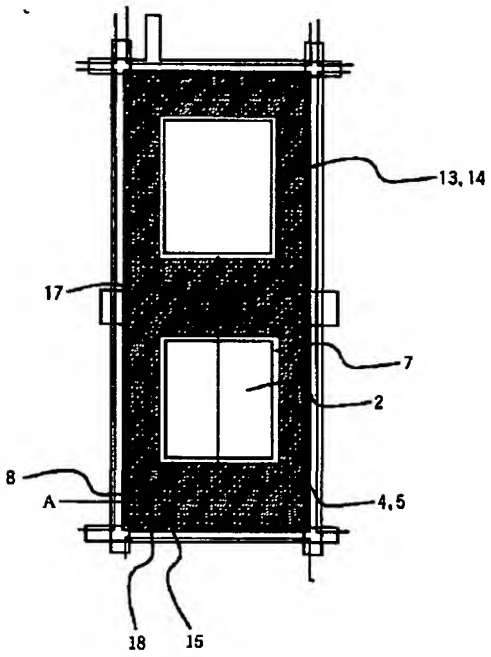
[Drawing 6]



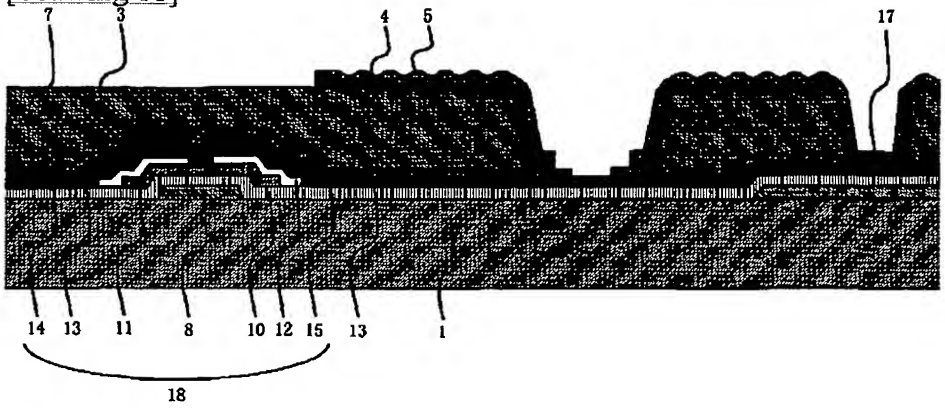
[Drawing 7]



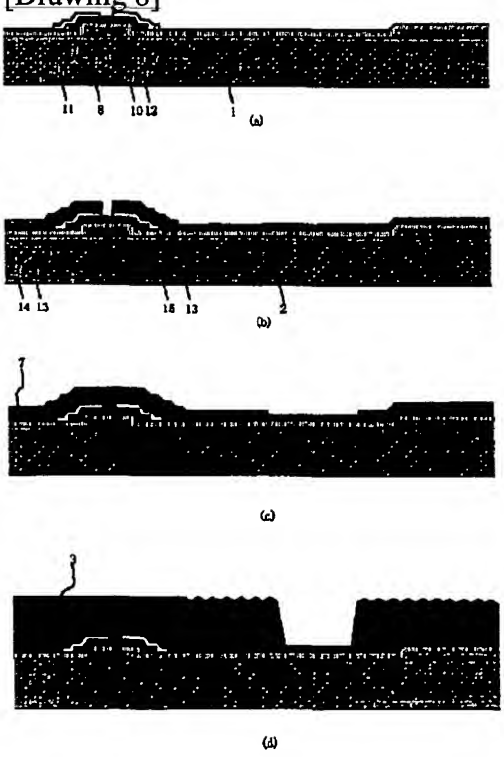
[Drawing 10]



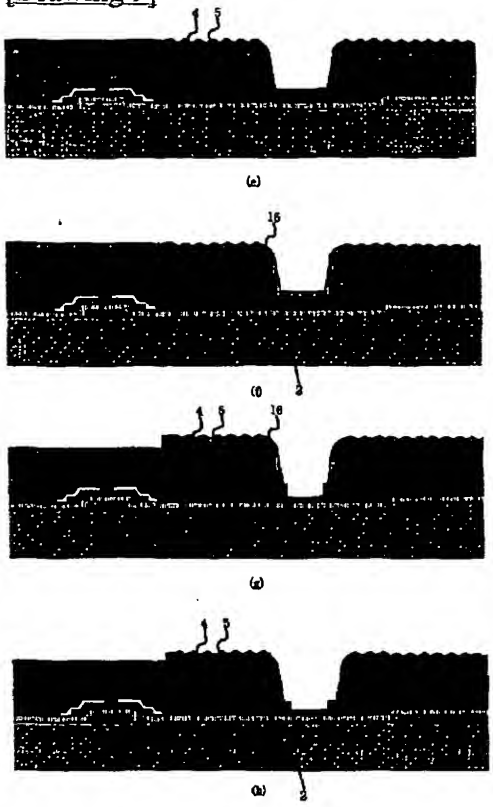
[Drawing 11]



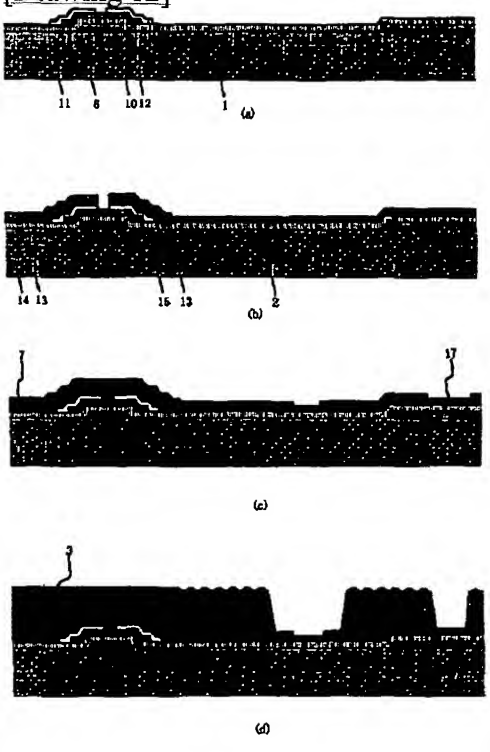
[Drawing 8]



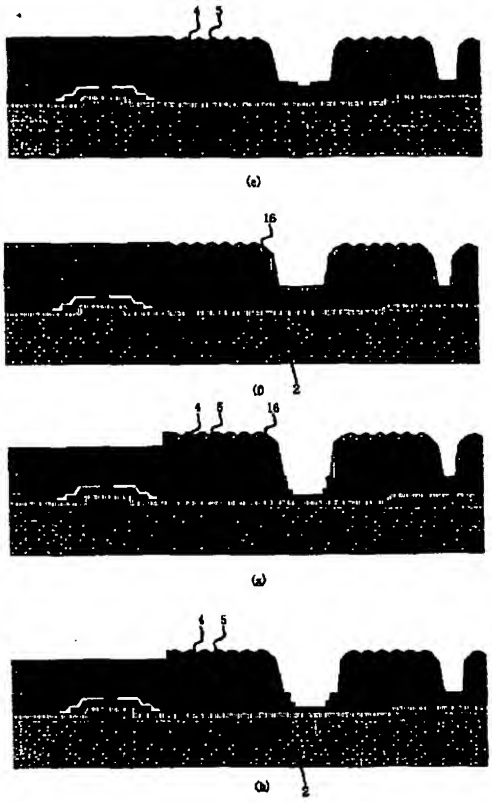
[Drawing 9]



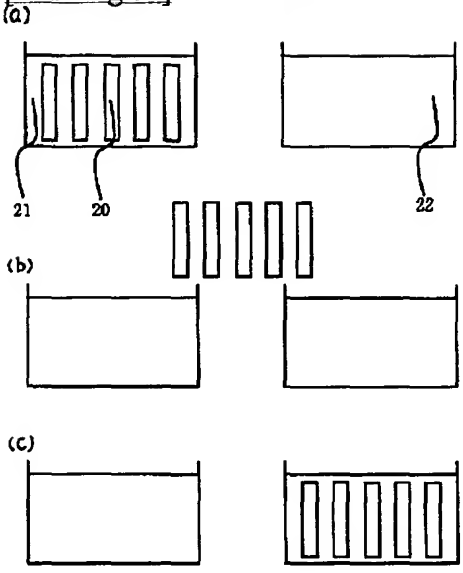
[Drawing 12]



[Drawing 13]



[Drawing 14]



[Translation done.]